Altruism and Social Integration*

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Abstract

We develop a two-stage experimental protocol by which *i)* we elicit the social network within a group of undergraduate students and *ii)* we measure their altruistic attitudes by way of a standard Dictator game. We observe that more socially integrated subjects are also more altruistic, as betweenness centrality and reciprocal degree are positively correlated with the level of giving, even after controlling for the effect of social distance, which has been shown to affect giving. Our findings suggest that social distance and network position are complementary determinants of altruistic behavior.

KEYWORDS: Altruism, centrality, social network experiments.
JEL CLASSIFICATION: C93, D85

1 Motivation

The so-called "Dictator Game" is a classic experimental protocol by which a subject (Dictator) decides unilaterally over the division of a fixed amount of money with another - usually anonymous - subject (Recipient). The anonymity of the protocol may suggest that Dictators may well keep all the money for

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themselves. However, this selfish behavior is rarely observed in the lab. In contrast, about 20% of the money is given to the Recipient under a wide variety of experimental conditions. This evidence is usually interpreted as an instance of *altruistic behavior*.[1]

In recent years, a large number of Dictator Game experiments have focused on several factors that may play a role as determinants of giving. Among these, we mention two streams of literature which are of interest for this paper:

1. *framing effects*; the way in which the Dictator's decision is presented to the subjects influences the results. One particular instance is the presence of "non-neutral" sentences highlighting the Recipient's dependency on the Dictator's decision.[2]

2. *social distance*; Dictator-Recipient and Dictator-Experimenter relationships have shown to affect the results. Social distance depends on the degree of anonymity among all the parties involved and is induced by the experimental conditions.[3]

This literature provides substantial evidence in support of the claim that both factors have a significant impact on the Dictator's donation.

The notion of "social distance" usually refers to the amount of information provided to the Dictator on the identity of the Recipient and/or the Experimenter. There are three noticeable exceptions to this approach, namely Jones and Rachlin (2006), Leider *et al.* (2009) and Goeree *et al.* (2009), where the notion of social distance between two subjects is related to how "close" they are in their "real-life social network" (e.g. whether they are "friends", "friends of friends" and so on). In this respect, the three studies show that altruistic behavior is decreasing in the social distance between the Dictator and the Recipient.

Nevertheless, this research leaves as an open question whether altruism is not only related to the distance to the Recipient, but more generally to the individuals' network position.[4]

The idea that altruism may be related to network position gets some support from the literature on the coevolution of social networks and prosocial norms (Eshel *et al.*, 1998; Boyd and Richerson, 2002; Marsili *et al.*, 2004; Nowak, 2006; Cassar, 2007; Fosco and Mengel, 2008). This literature analyzes the interplay of network structures and prosociality from a global perspective and show that social structures may contributre to the stability of prosocial behavior. However,

[1] See, among others, Hoffman *et al.* (1994, 1996), Eckel and Grossman (1996) and Bolton *et al.* (1998).

[2] See List (2007) for a survey and Brañas-Garza (2007) for an experimental study.

[3] See, among others, Bohnet and Frey (1999), Brañas-Garza (2006), Burnham (2003), Charness and Gneezy (2008) and Hoffman *et al.* (1994, 1996).

[4] Goeree *et al.* (2009) have also considered that individual network measures may affect altruism and use them as control variables, but their main focus is on the social distance to Recipients and their personal characteristics (such as height or shyness). In their regression, the inclusion of personal characteristics might be shading the effect of individual network measures.

little is known about how the degree of altruism and network position relate at the micro-level. In an evolutionary model, Fosco and Mengel (2008) show that in the steady state, where selfish and prosocial individuals coexist, the former are situated in the periphery of the network.[5] Cassar (2007) reports a significant effect of the number of neighbors (that is, a local measure of centrality) on cooperation, despite the fact that the network position is imposed in her experiment.[6]

The objective of the present paper is to test the following hypothesis: *Do socially integrated individuals exhibit more altruistic behavior, even after controlling for framing effects and social distance?* With this question we would like to contribute to the analysis of the relationship between social structures and social norms by focusing on a particular dimension of social networks, *social integration*, considered both from a *local* (i.e. at the level of each subject's neighborhood) and a *global* perspective (i.e. at the level of the whole network).

To this aim, we relate the measured level of altruism and the elicited real-life social-network position of individuals. In contrast to Leider *et al.* (2009) and Goeree *et al.* (2009), our data allow us to test whether this relation exists not only when people know the network distance to the Recipient, but also in an anonymous setting, where people do not know their identity. This design feature allows us to isolate the effect of network measures from that of social distance to the Recipient.

To explore the hypothesis of the paper, we design a two-stage experiment to elicit subjects' social network in their section and then obtain an indirect measure of their altruistic attitudes through the Dictator Game.

We use three treatment conditions which differ *along/in* the "frame" and "friendship" dimensions. Subjects' willingness to give is then related - together with treatment conditions - to some classic measures of integration used in network theory, such as

1. **In-degree:** the number of links leading to any given node (in our case the number of subjects who name subject i as a "friend");

2. **Out-degree:** the number of links starting from any given node (in our case the number of friends named by subject i);

3. **Reciprocal degree:** the number of bidirectional links (elicited friendships which are mutual);

[5] This is very well illustrated in Figure 1 of Fosco and Mengel (2008).

[6] A related idea is also present in the cross-cultural study of Henrich et al. (2001, 2004). They provide evidence that cross-cultural differences in prosocial behavior across small-scale societies are largely due to the characteristics of social institutions. Since the map of social relationships among the members of a society can be viewed as an informal institution, their results would suggest that more socially integrated societies would more likely adhere to a prosocial norm. Again, they leave the open question of whether, and if so how, social integration at the individual level correlates with the degree of prosociality. This issue may be very relevant in today's world, where most of the people belong to a "global" small-world network (Watts, 1999). Ensminger (2004) reports evidence from a small society in Africa that people who engage more often in non-kin business relationships with others tend to exhibit more altrustic behavior in anonymous experiments.

4. **Betweenness centrality:** the index which measures how "central" each subject is by counting the number of shortest paths connecting any pair of nodes in the network which pass through that particular subject. To obtain this index, we need to look *at the entire network architecture*, instead of simply considering the local properties of a given node.

These indexes measure the *embeddedness* (or *integration*) of a subject within a social network. More precisely, degree measures reflect the integration of each subject within her local neighborhood, while betweenness centrality reflects each subject's integration within the social network as a whole.

Our experimental evidence confirms previous results showing that both framing and social distance are important determinants of giving behavior. However, we show that framing and social distance do *not* affect the probability of selfish behavior (giving zero or the minimum possible amount).

More importantly, we observe that betweenness centrality and reciprocal degree have a positive and significant impact on subjects' willingness to give and also on the probability of observing selfish behavior. In contrast, in-degree (the subject's integration as perceived by others) and out-degree (the subjects' perceived integration within the group) are never significant for giving.

Moreover, given that we can separate the effect of network measures from that of social distance, the results suggest that the effect of individual network position on giving is *complementary* to the effect of social distance, previously analyzed in the literature.[7]

The remainder of the paper is arranged as follows. In Section 2 we present the experimental design, while our experimental results are reported in Section 3. Finally, conclusions are drawn in Section 4.

2 Design

The experiment was conducted at the University of Granada (Spain) in two sessions held the same day in January 2006. Subjects were first-year undergraduate students in Economics in the same section. The recruitment was made exclusively in the section and no one else was invited to participate in the experiment. Participation was voluntary. The section list contained 105 students, but only around 100 attended regularly and were aware of the experiment. The experiment was announced in class and 79 students agreed to participate. In total, 90 students were somehow involved in the network elicitation stage of the experiment, since 11 students from the same section were named as friends, but did not participate in the experiment. The students in the section had been attending the same courses for a whole semester so it is likely that at the time of the experiment they had got to interact and build a social network. Since first-year students from different sections do not take courses together, the inter-

[7] This role of the network position is reinforced by the observation that it also matters for the probability of selfish behavior, while framing and social distance do not.

action across (within) sections is much weaker (stronger).[8] This guarantees that we have clearly defined group bounds, which, together with the high participation, enable us to elicit a considerable fraction of the underlying social network of the population under study. We were extremely careful about preserving subject-experimenter distance to avoid any effects on subjects' willingness to give. For this reason, the experiment was conducted by assistants who had had no previous contact with our subjects.

2.1 Sequencing

The experiment was designed as a 2-stage protocol as follows:

Stage 1: *Network Elicitation.* The protocol for network elicitation was extremely simple: 79 subjects from the same section were asked to write down the name of their friends from the same section on a piece of paper; "one of whom would have the chance to be benefited later in the experiment". In total, the participating subjects named 79 names from the section list (68 were participating subjects and 11 were absent), creating 220 links among the students from the section under study.[9] At this stage, no information was provided about the type of decisions they would make afterwards, or what the possible benefit would be. However, since we were interested in subjects revealing the identity of their close friends, the instructions clearly stated that they might be given the chance to benefit only one of the friends, who would be randomly chosen from their list. Therefore, the more friends they listed, the lower the chance of benefiting any particular individual.

Given the incentives provided in the elicitation procedure, we may be capturing the network of people, who would like to benefit each other. As a result, we do not capture links to friends, whom our subjects would not like to see benefited, while we might capture links to people our experimental subjects would like to benefit without being friends. Nevertheless, since benefiting each other is an essential feature of friendship relationships and we explicitely asked for naming of friends, we interpret the elicted graph as the friendship network. In particular, our elicitation device yields a network of "close-friends",[10] since

[8] There are over 500 first-year undergraduate students in Economics at the University of Granada. They are divided into sections, which are generally composed of slightly more than 100 students. The student population of the whole University is around 60 thousand.

[9] There were 11 named students from the section, who did not participate in the experiment. We removed them from the empirical analysis and Figure 2. This affected 13 links. As a result, there are 79 nodes and 207 links in the subsequent analysis. In the main text, we focus only on the participating students, because we have no information about whether these links would have been reciprocated by the non-participating students, or about the giving decisions of these absent individuals. All the analysis has also been replicated including the non-present students in network measures and the results do not change. The analogous to Figure 2, including the removed links, can be found at http://www.ugr.es/~pbg/material/network.htm.

[10] There is no ideal network elicitation mechanism. When extracting the social links in real networks, scientists may always under- or overestimate the real network. Hence, it is better to choose the elicitation device according to the aim of the study. When looking for a dense but less precise network, one should provide incentives to report all the relations. On the contrary, to assure that elicited links are "stronger" it is better to give incentives to name

subjects were (made) aware of the fact that naming many friends would reduce the probability of favoring any one of them.[11]

Stage 2: *Dictator Game.* In session 2 the 79 participants were divided into 3 groups depending on the treatment (see "Treatments" below). Each group made the experiment in a separate room, but simultaneously. For all the treatments, subjects received two 11.5 x 22 cm. (4.5 x 8.8 in.) envelopes in their hand-out package. One envelope was empty, while the other contained 10 fifty-eurocent coins. The subjects were informed that their task was to divide this 10-coin endowment between themselves and another subject in whatever way they wished.[12]

2.2 Treatments

In the second stage, we had three block-design treatments structured according to the following two dimensions which have been shown to significantly affect subjects' willingness to give. The idea was to control for these conditions when measuring the "network effect" focus of our analysis.

1. **Friends/No Friends.** Depending on the treatment, subjects knew from the instructions whether the recipient would be a friend randomly drawn from their own list (treatment "Friends") or someone from their section with the exception of the friends they had named (treatment "No Friends").

2. **Frame/No Frame.** We also controlled for another treatment condition: *framing*. In this treatment half of the subjects who faced a no-friend as a Recipient had an additional sentence framing the Dictator Game which stated that the Recipient "*... would rely on them...*".

Thus, we had the following three treatments: Treatment 1, (No Friend/No Frame, "Baseline" hereafter), Treatment 2 (No Friends/Frame, "Frame" hereafter) and Treatment 3 (Friends/No Frame, "Friends" hereafter), with 26, 26 and 27 subjects, respectively.[13]

Each participant in Stage 2 played as a Dictator and was also a potential Recipient. The role of Recipients was randomly assigned from the section list,

fewer friends. We opted for the second option, because we were interested in "strong" ties, which we find more relevant for the analysis of generosity. For different applications it could be more useful to elicit not only strong links. Leider *et al.* (2009) and Goeree *et al.* (2009), for instance, use an incentive-based elicitation protocol in which subjects' monetary gain is non-decreasing in the number of elicited links and strictly increasing in the number of mutual links. As a result, the number of elicited links is substantially higher.

[11] This feature of the mechanism was actually explicitly mentioned in the instructions by stating "*Feel free to name as many friends as you wish. Remember, though, that the higher the number of friends you list, the lower the chances of benefitting a particular friend of yours*".

[12] The experimental instructions can be found at http://www.ugr.es/~pbg/material/network.htm.

[13] The introduction of the two treatments serves to see whether the effect of network position still matters even if framing and social distance play a role. Therefore, we did not tested the joint effect of framing and social distance in the experiment.

exluding the named friends, in Baseline and Framing treatments, while in the Friends treatment one subject from the list of friends was randomly drawn.

On average, subjects earned 4.5 euros (including a show-up fee of 2 euros). The payments to Recipients were distributed after the second session.[14]

3 Results

Dictator Game

Figure 1 shows the "box plots" representing the distribution of Dictators' offers in favor of the Recipient (integers from 0 to 6, given that no subject contributed with more than 6 coins) in the three treatments.[15] As Figure 1 shows, the Dictator keeps, on average, 8 coins for herself and gives 2 to the Recipient in the Baseline session. Very few Dictators (11%) shared their endowment equally, while 19% behaved completely selfishly and kept all the money for themselves. These results are in line with analogous experiments and make us confident that eliciting the network before the Dictator game did not affect the play in the game.[16]

Framing seems to enhance altruistic behavior as the entire distribution of Treatment 2 "shifts" up compared with the Baseline. As a consequence, equal splitting becomes much more frequent (19% of total observations). Concerning Treatment 3 (Friends), average offers further increase as does their variability. 37% of subjects give (at least) half of the endowment. Standard t-tests show that giving is significantly larger in Friends and Framing treatments with respect to the Baseline ($t = -2.524$, $p = .007$ and $t = -2.437$, $p = .009$, respectively; one-tailed tests).

In contrast, the difference between Framing and Friends is not statistically significant ($t = -0.222$, $p = .825$; two-tailed test). We see that the average giving is virtually the same in both treatments. The only difference is the variability. Figure 1 suggests that the distribution of Dictators' gifts is more dispersed in Friends treatment.

The comparison of the results with Goeree *et al.* (2009) and Leider *et al.* (2009) also suggests that our network elicitation mechanism does not induce any behavioral bias into the Dictators' decisions. In the present study, the difference between Baseline and Friends treatments shows that subjects give 49% more to their friends with respect to any random individual at a distance larger than one. Goeree *et al.* (2009) report 36% larger giving to first-order neighbours with respect to more distant individuals, while Leider *et al.* (2009) observe an

[14] Since Recepients have been drawn randomly from the complete section list in case of Baseline and from the friend list in the Friends treatment, some Recipients were absent. These were contacted and paid later.

[15] The boxes show 50% of the total observations (from the 25% to the 75% percentile). Adjacent lines trace the first upper and lower adjacent values, while points denote outliers. The line within the box denotes the median. The broken line connects the means of the three distributions.

[16] See Hoffman *et al.* (1996) and Eckel and Grossman (1996).

increase of 52% in giving to first-order neighbours rather than strangers. The effect in our experiment lies between these two values.

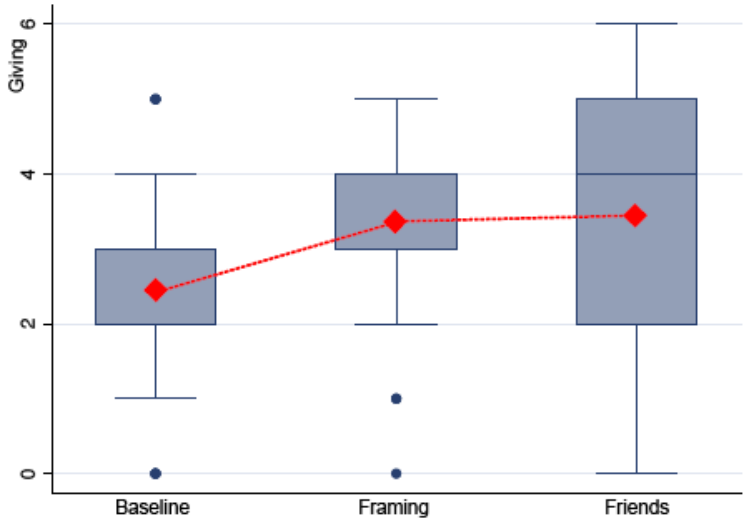

Fig. 1: Distributions of Dictators' giving in Stage 2

Network

Figure 2 provides us with a mapping of the directed network (from the subject naming a friend to the named subject) of our experimental subject pool. Each subject is represented by a circle. The black nodes correspond to "selfish" individuals, i.e. subjects who gave nothing or the smallest possible amount (about 19% of our subject pool), while the white nodes are subjects who gave more than one. On average, subjects named 2.78 including links to non-participating students, and were named by 2.62 friends.[17] The degree of reciprocation is 50.5% in the data. This percentage is higher than in other studies. Leider et al. (2009) report 36.7% of reciprocal links and the fraction is roughly 30% in Add Health data (Goodreau, 2007).[18] High reciprocity with respect to other studies, jointly with lower average degrees, confirms that our elicitation procedure is more suitable for elicitation of close relationships.[19]

There are two salient features of the network architecture. First, most of the nodes are embedded in a giant "component" (i.e. they are connected through some path). Second, the architecture of this component is a combination of *interlinked clusters*, either in the form of stars or (almost) complete graphs. A more detailed analysis shows that our network resembles standard social network

[17] The histograms for indegree and outdegree, as well as reciprocal degree and betweenness, can be found at http://www.ugr.es/~pbg/material/network.htm.

[18] Goeree *et al.* (2009) do not report this statistic.

[19] The average indegrees are around 10 and 4.4 for Leider et al. (2009) and Goeree et al. (2009), respectively.

structures, that is, relatively low average distances, and high clustering with respect to a random network (Watts and Strogatz, 1998). The average distance between reachable nodes, that is between the nodes in the giant component, is 5.4, abstracting from the directionality of links. Since this number is of the order of logarithm of the size of the network ($\log(79) \simeq 4.369$), we can say that the average distances are low in the data. The average clustering coefficient (i.e. the relative frequency of neighbors who are directly linked themselves) is 0.38 (st.dev. 0.29). In a large randomly generated network with n nodes and average degree of $\overline{d}$, the expected clustering coefficient would be roughly $\frac{\overline{d}}{n}$. For a random network with our size and connectivity, we get 0.03. This number is an order of magnitude lower that the clustering observed in the elicited network. Additionally, we find that our network shows positive assortativity: those who are more social tend to be connected to social individuals.[20] Most of these features have been found in other empirical social networks (see Goyal (2007) or Jackson (2008)).[21]

Figure 2 also provides a rough idea of our main result: less central subjects are more likely to give less. Abstracting from the direction of nodes, note that, in general, the position of the black nodes in the graph is either peripheral (subjects 6, 20, 24, 46, and 59) or they are embedded in completely connected clusters (2, 29, 34, 37, 38, 50, 63, and 66). In both cases, the potential removal of these nodes does not have a large effect on the (inter)connectivity of the remaining nodes,[22] that is, these nodes are not crucial for the network architecture.[23]

[20] Using the coefficient of assortativity proposed by Newman (2002), we find positive assortativity in our data ($r = 0.19$ for in-degree and rises to $r = 0.50$ for reciprocal degree).

[21] Even though positive assortativity is observed in many social networks, Jackson (2008, Chapter 3.2.4) correctly points out that there are too many exceptions, and makes a call for a more systematic analysis of this issue.

[22] Even though the removal of subject 50 would disconnect subject 26, this effect is weak on the overall connectivity of the network.

[23] An exception seems to be subject 12, who creates a bridge between two components. However, she names three nodes as her friends, but none of these links is actually reciprocated.

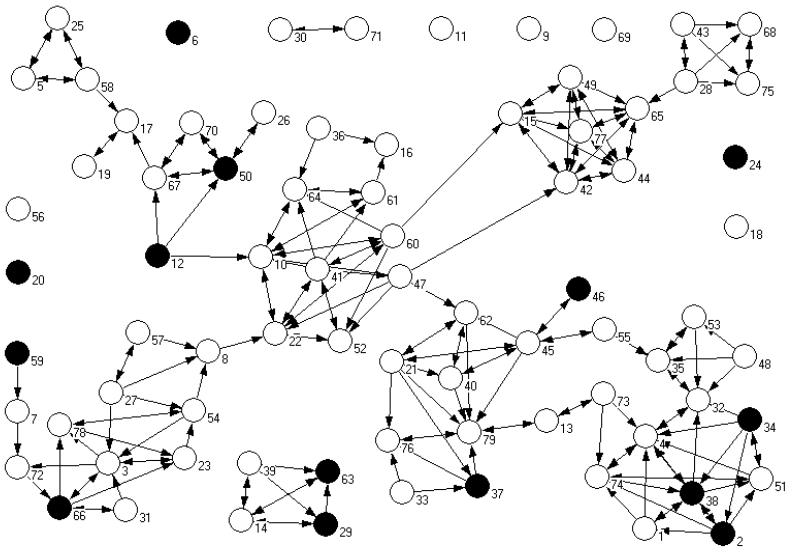

Fig. 2: Social links and contribution profiles

Clearly, the analysis of Figure 2 does not properly account for treatment conditions. In Table 1 we perform a regression analysis including treatment variables. Network centrality is captured through binary indexes[24] which take value 1 if the corresponding subject is characterized by a level above the median of the corresponding centrality measure (in-degree, out-degree, reciprocal degree and betweenness) and 0 otherwise.

We run two types of regressions. In the first case, regressions [1a] to [4a], we use *altruism* as a dependent variable, whereas regressions [1b] to [4b] analyze *selfishness*. Each of the four models considers one network measure (in-degree, out-degree, reciprocal degree and betweenness). More precisely,

Regress. [1a] to [4a]: the probability of any possible level of giving (an integer from 0 to 6) is estimated by an ordered logit regression using network measures, gender[25] and treatment dummies (Friends and Framing) as explanatory variables.

Regress. [1b] to [4b]: the probability of belonging to the group of "selfish" subjects (see Figure 2) is estimated by a logit regression using network measures, a constant, gender and treatment dummies as explanatory variables.

[24] We use dummies to better capture non-linearities in the underlying relations. Analogous results can be obtained using the indexes and the indexes squared.

[25] We control for gender, since it has been observed that women tend to be more generous than men (see, for example, Andreoni and Vesterlund, 2001; Croson and Gneezy, in press, and Eckel and Grossman, 1998).

Table 1: Regressions for Giving and Selfishness

	Altruism [1a]	Selfish [1b]	Altruism [2a]	Selfish [2b]	Altruism [3a]	Selfish [3b]	Altruism [4a]	Selfish [4b]
In-degree	.228	-1.179*	-	-	-	-	-	-
	(.424)	(.695)	-	-	-	-	-	-
Out-degree	-	-	-.361	-.240	-	-	-	-
	-	-	(.478)	(.765)	-	-	-	-
Rec. degr.	-	-	-	-	1.001**	-1.750**	-	-
	-	-	-	-	(.454)	(.805)	-	-
Between.	-	-	-	-	-	-	1.037**	-1.790***
	-	-	-	-	-	-	(.473)	(.712)
Gender	.959**	-1.035	1.123**	-1.271**	.678	-.963	.666	-.875
	(.451)	(.630)	(.464)	(.646)	(.463)	(.641)	(.466)	(.653)
Friends	1.788***	-.835	1.649***	-.600	2.028***	-1.226	1.900***	-1.018
	(.546)	(.730)	(.559)	(.729)	(.556)	(.786)	(.550)	(.765)
Fram.	1.409***	-1.385*	1.278**	-1.150	1.620***	-1.718**	1.480***	-1.483*
	(.513)	(.814)	(.515)	(.806)	(.522)	(.868)	(.511)	(.851)
Cons.	-	.281	-	-.198	-	.594	-	.644
		(.641)		(.606)		(.701)		(.690)

Standard errors are in parentheses. N=79,(P>$\varkappa^2$)<.05.

***, **, and * indicate significance at p = 0.01, 0.05, and 0.10, respectively.

In Table 1, the coefficients in regressions [1a] to [4a] measure the average percentage increase in giving for subjects with network measures abouve the median, while in regressions [1b] to [4b] they measure the percentage increase in the probability of showing a selfish behavior.

First, notice that betweenness centrality and reciprocal degree coefficients are always significant. The negative sign of the coefficients of these variables in regressions [3b] and [4b] indicates that a subject with a high reciprocal degree or betweenness is less likely to be selfish. The positive signs of the coefficients in regressions [3a] and [4a] show that these measures of integration have a positive effect on the level of giving. In contrast, neither out-degree nor in-degree is significant at 5% in our models.

The second pattern worth stressing is the finding that treatment variables (Friends and Framing) have a large and significant impact in equations [1a] to [4a], while they are (almost) never significant at 5% in regressions [1b] to [4b]. In other words, our treatment variables affect the level of giving, but they have no effect on whether subjects belong to the group of most selfish individuals. The first part of this finding, the influence of treatment variables of the level of giving, is known: both social distance and framing have a positive effect on the level of giving. Our treatment variable Friends measures the effect of social distance (when $Friends = 1$, the Dictator shares her endowment with a subject at "distance one" from her, whereas the distance between the Dictator and the Recipient is larger when $Friends = 0$). In this respect, our estimates

confirm previous results in the literature: people are more altruistic toward socially closer individuals (see also Figure 1). Similar considerations apply for the Framing effect.

However, the probability of a selfish offer does not seem to be affected as much by the treatment variables (Friends is never significant and Framing is significant at 5% only in regression [3b]). Playing with friends does not have an impact on the probability of selfish behavior, but it does affect the level of giving. For the other treatment variable, Framing, its effect is also stronger on the level of giving than on the probability of selfish behavior.

To interpret these results, let us remember that betweenness is a "global" measure of a subject's social integration, while the degree measures concern integration at a local level. In-degree and out-degree reflect local integration, either as it is perceived by others (the number of subjects who consider i as a friend), or by the subject herself (the number of subjects that i considers as friends). Finally, reciprocal degree includes aspects of the last two and requires a coincidence between i's perceptions and those of others, given the additional requirement of reciprocity.[26] In this respect, our results indicate that only "strong" measures of social integration matter for altruism. At a local level, we have shown that reciprocal degree is highly significant both for the level of giving and for the probability of selfish behavior. The same result holds for the global measure of social integration.

We have identified a link between social integration and altruism which becomes stronger, the stronger the corresponding measure. Hence, both globally and locally, more integrated subjects tend to be more altruistic, even after controlling for gender and treatment effects.

Given the complementary role of social distance and centrality in giving behavior, we also checked whether the effect of centrality may be influenced by social distance. Table 2 in the appendix shows that this is not so in any of regressions from Table 1. The dummy for the interaction between the corresponding measure of centrality and Friends is never significant.

To test the robustness of the main finding of this paper, the link between network centrality and altruism, we ran the regressions from Table 1 excluding the observations from the Friends treatment. As Table 3 in Appendix reports, the findings are not driven by the Friends treatment and hold even when people only deal with non-friends.

Last, we ran regressions of the same dependent variables over two alternative measures of network position of individuals: clustering coefficient and Bonacich eigenvector centrality. The former measures the frequency of neighbors of a particular node that are neighbors themselves, while the latter is an alternative measure of centrality, which takes into account all paths starting from a node, including non-directed ones. There is no significant relation between our dependent variables and these two measures ($p > .32$ in all cases) and none of the models is jointly statistically significant on traditional 5% significance level (see

[26] Reciprocity is actually one of the requirements listed by Granovetter (1973) to distinguish between "weak" and "strong" ties.

Table 4 in Appendix).

4 Discussion

This paper explores the relationship between social integration and altruistic behavior. Our results show that social network architecture matters for altruism at both the local and the global level. We control for other significant factors already highlighted in the literature such as gender, framing or social distance. Even after controlling for these variables, social integration remains an important factor for giving and selfish behavior.

Our main contribution is thus the idea that the effect of social distance, previously analyzed in the literature, is complementary to the effect of network position and that both seems to be important determinants of altruism.

Our statistical exercise in Table 1 would seem to suggest a causal relationship between network centrality and altruism, since network variables are in the list of regressors.[27] This estimation strategy follows the empirical literature on network/peer effects in which network architecture is a primitive of the economic environment. Nevertheless, the authors of this literature are well aware of the fact that subjects' individual characteristics may also influence their position in the network, making it difficult to disentangle the "pure network effect" from individual heterogeneity (Durlauf, 2008).

In the context of our data set, the same dilemma can be posed as follows: *Are subjects (on average) more altruistic because they are pivotal in their social network, or are they pivotal because they show (for whatever reason) a more altruistic attitude toward the rest of the group?* Concerning this point, it is worth mentioning the vast experimental evidence on the persistence of sharing rules across life stages. This literature reports that there is a certain evolution of the norm adherence during childhood, but once early adulthood is reached, the norm adherence seems to remain constant (Benenson *et al.* 2007; Krause and Harbaugh, 2000; Sutter and Kocher; 2007). Since our experimental subjects are university undergraduates, it is reasonable to assume that these prosocial processes are already well established for our subject pool, thus contributing to the dynamics of friendship network formation. For this reason, it may well be the case that an individual altruistic attitude may favor greater integration in the social network.

In our experimental protocol, even though the decision of giving was made *after* the network elicitation and the social network of Figure 2 was already well established at the time subjects had to make their contribution decision,[28] it is clear that both the social abilities and the social norms of the subjects *as well as* personality traits were determined long before the experiment.[29] Our

[27] This is also the same estimation strategy followed in the experimental papers of Leider *et al.* (2007) and Jones and Rachlin (2006).

[28] Note also that Stage 1 decisions contribute to the matching protocol of Stage 2 (and in this sense, network elicitation affects giving decisions, albeit indirectly).

[29] A recent paper by Fowler et al. (2009) indeed suggests that network position may be

interpretation of the results is that given the social abilities and norms of the individuals, they formed a social network in their class and *in that social network* we measured their willingness to share a given endowment. Our analysis allows us to state that their behavior in sharing the endowment (i.e. their generosity) with other members of the network is affected by their position in that network.

A very similar problem is faced by Calvó-Armengol *et al.* (2005), who estimate peer group effects in education patterns of a sample of US adolescents. The richness of their database -the National Longitudinal Survey of Adolescent Health, the "Add Health"- allows them to mitigate this problem by controlling for proxies of "leadership" and "self-esteem" which are correlated with the variable of interest, but also can affect subjects' position in their social network. Our data does not allow us to replicate such an estimation strategy. However, experimental methods could allow us to control network dynamics and their coevolution with subjects' behavioral *treatments* in much more detail. The analysis of this question is left for future research.

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partially genetically determined.

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5 Appendix

Table 2: Regressions for Giving and Selfish. with Interactions

	Indegree centr.		Out-Degree centr.		Rec. Degree centr.		Betweenness centr.	
	Altruism	Selfish	Altruism	Selfish	Altruism	Selfish	Altruism	Selfish
	[5a]	[5b]	[6a]	[6b]	[7a]	[7b]	[8a]	[8b]
Centrality	.241	-1.353	-.743	-.240	1.109**	-1.750**	1.086**	-1.790***
	(.456)	.892	(.485)	(.765)	(.484)	(.805)	(.449)	(.712)
Centr. × Friends	.227	.321	1.473	(a)	-.071	(a)	-.149	(a)
	(978)	(1.493)	(1.138)		(.930)		(1.088)	
Gender	.775	-.984	.959**	-1.271**	.505	-.963	.639	-.875
	(.486)	(.618)	(.481)	(.646)	(.520)	(.641)	(.486)	(.653)
Friends	1.500*	-.884	1.081	-.600	1.912**	-1.226	1.716*	-1.018
	(857)	(.872)	(.718)	(.729)	(.810)	(.786)	(1.038)	(.765)
Fram.	1.246***	-1.367	1.026**	-1.150	1.489***	-1.718**	1.432***	-1.483*
	(.497)	(.887)	(.508)	(.806)	(.482)	(.868)	(.494)	(.851)
Cons.	-	1.259	-	-.198	-	.594	-	.644
		(1.036)		(.606)		(.701)		(.690)

(a) variable dropped. Standard errors are in parentheses. N=79, (P>$\varkappa^2$)<.1.

***, **, and * indicate significance at p = 0.01, 0.05, and 0.10, respectively.

Table 3: Regressions for Non-Friends Treatments

	Altruism	Selfish	Altruism	Selfish	Altruism	Selfish	Altruism	Selfish
	[9a]	[9b]	[10a]	[10b]	[11a]	[11b]	[12a]	[12b]
In-degree	.289	-1.347	-	-	-	-	-	-
	(.516)	(.904)						
Out-degree	-	-	-.814	.497	-	-	-	-
			(.546)	(.957)				
Rec. degr.	-	-	-	-	1.351**	-1.566	-	-
					(.578)	(.988)		
Between.	-	-	-	-	-	-	1.271**	-1.914**
	-	-	-	-	-	-	(.514)	(.886)
Gender	.646	-1.068	.952	-1.391	.264	-1.018	.478	-1.048
	(.641)	(-779)	(.614)	(.869)	(.702)	(.776)	(.634)	(.805)
Fram.	1.415**	-1.369	1.187**	-.932	1.733***	-1.598*	1.646***	-1.509*
	(.595)	(.893)	(.599)	(.864)	(.585)	(.978)	(.603)	(.817)
Cons.	-	1.383	-	.924	-	1.493	-	1.530
		(1.215)		(1.181)		(1.203)		(1.349)

Standard errors are in parentheses. N=52,(P>$\varkappa^2$)<.1

***, **, and * indicate significance at p = 0.01, 0.05, and 0.10, respectively.

Table 4: Regressions for Giving and Selfishness over Clustering and Eigenvector Centrality

	Altruism [13a]	Selfish [13b]	Altruism [14a]	Selfish [14b]
Clustering	-.200	.428	-	-
	(.442)	(.650)	-	-
Eigenvector centrality	-	-	.165	-.548
	-	-	(.442)	(.633)
Gender	.916*	-1.322**	.792	-.999*
	(.494)	(.645)	(.508)	(.605)
Friends	1.542**	-.457	1.578***	-.616
	(.628)	(.696)	(.602)	(.648)
Fram.	1.158**	-1.008	1.231**	-1.210
	(.498)	(.783)	(.483)	.826
Cons.	-	.805	-	.866
		(1.008)		(1.000)

Standard errors are in parentheses. N=79,(P>$\varkappa^2$)>.05.

***, **, and * indicate significance at p = 0.01,0.05 and 0.10, resp.